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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference JL3697	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/01414	International filing date (day/month/year) 01.04.2003	Priority date (day/month/year) 02.04.2002
International Patent Classification (IPC) or both national classification and IPC C22B1/00		
Applicant THE UNIVERSITY OF NOTTINGHAM et al.		



- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 7 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 23.10.2003	Date of completion of this report 12.07.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Bjoerk, P Telephone No. +49 89 2399-8452 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB 03/01414

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-5, 7, 9-46 as originally filed
6, 8 filed with telefax on 25.02.2004

Claims, Numbers

1-26 filed with telefax on 25.02.2004

Drawings, Sheets

1/29-29/29 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

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EXAMINATION REPORT**

International application No. **PCT/GB 03/01414**

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	25,26
	No: Claims	1-24
Inventive step (IS)	Yes: Claims	25,26
	No: Claims	1-24
Industrial applicability (IA)	Yes: Claims	1-25
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item I

Basis of the report

1. The application relates to methods and apparatuses of pre-treatment of a multi-phase material prior to a subsequent operation, such as grinding. By applying microwaves for a maximum of 0,5 second, the bond between the phases in the material is weakened by differential expansion of the phases which leads to a lower energy consumption for the subsequent operation.

Claim 1 features treatment with microwaves of a power density of at least 10^9 Wm^{-3} for a time of 0.5 second or less, followed by passing the material out of the treatment area for a subsequent operation.

Claim 18 relates to an apparatus adapted to the process of claims 1-17.

Claim 22 relates to a method of continuous processing of ore or rocks by applying microwaves followed by a mechanical breaking up of the rocks.

Claim 24 relates to an apparatus adapted to the process of claims 22 and 23.

Claim 25 relates to a method as in claim 1 with additional features relating to throughput of material, a time of 1 ms or less, pulses of energy and overall bulk temperature.

Claim 26 features a processing of ore with microwaves for a time of less than 0.1 second.

2. In the amended set of claims filed on 25.02.04, the phrase "for a short enough time to avoid causing substantial chemical changes to one, or both of the phases of the multi-phase material" has been introduced into method claim 1, the similar phrase " a time that is short enough to avoid causing substantial chemical change to the material" into apparatus claim 18 and "at a speed that is fast enough to avoid causing substantial chemical change to the ore or rocks" into method claim 22.

No basis for these amendments in the application as originally filed have been indicated by the applicant in his letter of 25.02.04. The description does not appear to discuss any link between the time/speed and chemical changes. Only

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claims 25 and 26 feature the following phrases:

claim 25: "wherein the temperature of the phases of the multi-phase material is kept low enough to avoid significant changes to the chemical properties of the different phase materials";

claim 26: "applied for a short enough time to cause differential thermal expansion between materials of different phases to cause weakening between phases whilst avoiding causing significant chemical changes to the ore, or at least to the mineral to be extracted."

Claim 26 is an independent claim as indicated above and it relates to the processing of an ore in order to increase the yield of mineral extraction, whereas claims 1, 18 and 25 relate to a general method and apparatus for microwave pretreatment of a multi-phase material. The description cites for example de-husking nuts, drying materials, food processing (page 43, lines 4-11).

The application of the time-chemical changes feature of the specific embodiment of claim 26 to the broad methods and apparatuses of claims 1, 18 and 25 is seen as an amendment going beyond the disclosure in the international application as filed and is therefore contrary to the requirement of Art.34(2)(b) PCT.

The present report is therefore established as if these amendments had not been performed. The other amendments made to the text of the claims, rendering the presence of microwaves compulsory as well as the amendments made to the description on pages 6 and 8 are seen as allowable with regard to Art.34(2)(b) PCT.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

- D1: US-A-5 824 133 (TRANQUILLA JAMES M) 20 October 1998 (1998-10-20)
- D2: DATABASE WPI Section PQ, Week 198810 Derwent Publications Ltd., London, GB; Class P41, AN 1988-069337 -& SU 1 326 334 A (AS UKR)

GEOTECH MECH INST CONS BUR), 30 July 1987 (1987-07-30)
96-01), pages 43-54

D1 corresponds to WO97/34019 cited on page 4 of the description of the present application. In the process of D1, a stream of ore is subjected to microwave energy before subsequent operation such as conventional recovery processes by comminution, roasting, leaching etc. (col.1, l.10-14; col.4, l.7-8). To avoid energy dissipation, the dwelling time in the microwave treatment zone is short, less than 6 sec. and preferably in the area of 0.25 sec. (col.3, l.58-60). A corresponding apparatus is also disclosed (Fig.2). The main purpose of the microwave pre-treatment in D1 appears to be for bringing about metallurgical effects which make the ore more amenable to leaching techniques or which lead to phase transformations (col.1, l.20-35).

D2 discloses pretreatment of ore prior to milling by heating the ore with standing microwaves. The ore is circulated on a conveyor belt through the treatment zone before being fed to the milling unit. The pretreatment destroys the bonding between ore and non-ore phases (Abstract, Figure).

2. As indicated under Item I above, the set of claims is read as not having the features related to the time-chemical changes.

The process disclosed in D1, with a preferred dwelling time of 0.25 sec. is novelty destroying to the subject matter of claims 1 and 22. The apparatus described in D1 contains all the features of claim 18.

The process and apparatus described in D2 is directly novelty destroying to the subject matter of claims 22 and 24. These claims do not refer to any exposure times to the microwave field.

The subject matter of these independent claims does therefore not fulfil the requirements of Art.33(2) PCT.

Regarding the dependent claims, their features are to a large extent to be found in the disclosure of D1.

3. Neither D1 nor D2 discloses microwave treatment times of 0.1 sec. or less. Such short treatment times appear also not to be disclosed as such in the remaining

prior art cited in the International Search Report.

With regard to the method of claim 25, the disclosures of D1 and D2 are not seen as novelty destroying as the overall bulk temperature is not limited to a maximum of 40°C in order not to achieve significant changes to the chemical properties of the material. Such a limitation appears also not to be disclosed as such in the remaining prior art cited in the International Search Report.

4. The set of figures does not fulfil the requirements of Rule 11.11(a) PCT as the figures should in principle not contain any words such as the legends in Figs.5 to 19 and the tables 1 to 8.